

WHAT IS CLAIMED IS:

1. A multi-mode shutdown system for use with a fuel metering unit of an engine, comprising:
 - (a) a shutoff valve operative to selectively block an output flow from the fuel metering unit;
 - (b) a shutdown solenoid in fluid communication with the shutoff valve for selectively closing the shutoff valve;
 - (c) an orifice for creating a minimum flow from the output flow from the fuel metering unit; and
 - (d) a minimum flow solenoid in fluid communication with the minimum flow for selectively blocking a minimum flow path for the minimum flow to the engine, wherein: (i) during a normal operation mode, the shutdown solenoid opens the shutoff valve and the minimum flow solenoid blocks the minimum flow path to the engine such that the engine receives the output of the fuel metering unit; (ii) during a shutdown mode, the minimum flow solenoid blocks the minimum flow path to the engine and the shutdown solenoid closes the shutoff valve such that the shutoff valve blocks the output of the fuel metering unit to stop fuel flow to the engine; and (iii) during a minimum flow mode, the shutdown solenoid closes the shutoff valve, and the minimum flow solenoid opens such that the minimum flow passes to the engine via the minimum flow path.

2. A fuel metering unit as recited in Claim 1, wherein the minimum flow is regulated.
3. A fuel metering unit as recited in Claim 1, wherein the minimum flow is at an elevated pressure.
4. A fuel metering unit as recited in Claim 1, wherein the minimum flow path passes through the shutdown solenoid.
5. A fuel metering unit as recited in Claim 1, wherein the shutdown solenoid connects to the output of the fuel metering unit such that the output closes the shutoff valve.
6. A fuel metering unit as recited in Claim 1, wherein the minimum flow solenoid connects the shutoff valve to a low reference pressure during the shutdown mode and the normal operation mode.
7. A fuel metering unit as recited in Claim 1, further comprising a head regulator in fluid communication with the minimum flow orifice for maintaining a pressure differential across the orifice.

8. A fuel metering unit as recited in Claim 1, wherein the minimum flow solenoid creates a shutdown flow path for the output of the fuel metering unit to return to a low reference pressure during the shutdown mode.

9. A multi-mode shutdown system for a fuel metering unit comprising:
a valve connected between the fuel metering unit and an engine wherein during normal operation, the valve provides a flow path from the fuel metering unit to the engine;
first means operatively connected to the valve for selectively stopping fuel flow to the engine by closing the valve; and
second means operatively connected to the engine for selectively providing a minimum flow of fuel to the engine.

10. A multi-mode shutdown system as recited in Claim 9, wherein the first means is a solenoid having an inlet connected to a pressurized fuel line and an outlet connected to the valve.

11. A multi-mode shutdown system as recited in Claim 9, wherein the second means is a solenoid having an inlet connected to the minimum flow and an outlet connected to the engine.

12. A multi-mode shutdown system as recited in Claim 11, further comprising third means for creating the substantially minimum flow.

13. A multi-mode shutdown system as recited in Claim 12, wherein the third means is an orifice for limiting flow through a line connected between an output of the fuel metering unit and the second means.

14. A multi-mode shutdown system as recited in Claim 12, wherein flow through the third means is regulated.

15. A multi-mode shutdown system for use with a fuel metering unit of an engine, wherein the fuel metering unit includes: a positive displacement pump for generating increased pressure; a main metering valve in fluid communication with the positive displacement pump for varying an output of the fuel metering unit; a head regulator operative to maintain a pressure differential across the main metering valve; a shutoff valve operative to selectively close the output; and a shutdown solenoid in fluid communication with the valve for selectively closing the valve, the multi-mode shutdown system comprising:

(a) a minimum flow solenoid in fluid communication with a minimum fuel flow for selectively providing the minimum fuel flow to the engine, wherein:

(i) during normal operation, fuel enters the positive displacement pump and the pressure is increased, the main metering valve receives the fuel and a pressure differential across the main metering valve results in the fuel exiting the main metering valve at a lower pressure, the shutdown solenoid opens the shutoff valve, the fuel enters the shutoff valve and exits to the engine, the head regulator maintains the pressure differential across the main metering valve, and the minimum flow solenoid blocks the minimum fuel flow from the engine;

(ii) during a shutdown mode, the minimum flow solenoid blocks the minimum fuel flow to the engine and the shutdown solenoid closes the shutoff valve to stop fuel flow to the engine; and

(iii) during a minimum flow mode, the shutdown solenoid closes the shutoff valve, and the minimum flow solenoid provides the minimum fuel flow to the engine.

16. A multi-mode shutdown system as recited in Claim 15, wherein during normal operation, the minimum flow solenoid connects the shutoff valve to a low reference pressure such that the shutoff valve is open.

17. A multi-mode shutdown system as recited in Claim 15, further comprising a minimum flow orifice in fluid communication with the output of the fuel metering unit for creating the minimum fuel flow.

18. A multi-mode shutdown system as recited in Claim 17, wherein the minimum fuel flow is regulated by the head regulator.

19. A multi-mode shutdown system as recited in Claim 17, wherein the minimum fuel flow passes through the shutdown solenoid.